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Remote Sensing and GIS Based Land use/Land cover Change Detection Mapping in Saranda Forest, Jharkhand, India

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Abstract

Land use/land cover is a significant element for the interconnection of the human activities and environment a monitoring which is useful to find out the deviations to save a maintainable environment. Remote sensing is a very useful tool for the affair of land use or land cover monitoring, which can be helpful to decide the allocation of land use and land cover. This study involves the assessment of land use or land cover vicissitudes beginning of the year 1992, 2005 and 2014 of the Saranda forest. In the classification map, statistics, matrix has been performed, and the user accuracy is collected for every class. To read the thematic maps and ground truth survey, GIS software (ArcMap) has been employedtocarry out the classification and to check the accuracy. It is mandatory to detect carefully the land use or land cover vicissitudes for continuing a sustainable environment for a real growth. The result of the work shows the quick expansion of built-up (mining area), wasteland, open forest, agricultural land and lessening the dense forest area and the water bodies.

Keywords: Remote sensing, land use and land covers, change detection, accuracy assessment, GIS.

Introduction

Monitoring of land use and land cover change has become an interesting area of research for Geo scientists understand the strategies for managing natural resources and monitoring environmental changes. Quantification of changes such as land use and land cover is viable among GIS procedures level if the subsequent spatial datasets are of dissimilar scales or resolutions[1]. Since land is becoming a short resource due to vast agricultural and demographic factors[2], the RS and GIS can play an important role in this concern to proper use of the natural resources. Monitoring land use or land cover are vital in countryside and is can provide a complete comprehension of the interface and connection of anthropogenic action with the environment[3]. The change in land use/land cover as well includes the change, also direct or indirect, of a natural environment and their influence on the ecosystem of the area. Land use / cover change has got a vital element in the present scheme for management natural resource and detect environmental deviations[4]. In this present study, it has been shown the changes in the area of the natural resource. As a human action the bound to the terrestrial below forest is receiving lessen. The real mansion people and the parcel organizers are conducting a thoughtful catastrophe to forest land and agricultural land. This is insalubrious condition of land administration. In these ambient studies of land use/land cover alteration finding is critical to conclude the ongoing status and strategy for the future. The present study reports the varied land use/ land cover changes and class of the study area.

Study area: The Saranda forest of Jharkhand is endowed with amount of rich iron ore deposits. The forest is situated in West Singhbhum district of Jharkhand, India. It is famous as Asia's largest Sal forests and is an important elephant habitat. The location of the forest is within latitude 22° 00' 45.04"- 22° 12' 36.81" N and longitude 85° 08' 18.8" - 85°24'37.21"E with an average elevation of 750m above the mean sea level (MSL). Saranda forest is fed by two major rivers, Karo and Koina. The catchy of these rivers comprises of a drainage system with stream order up to six. Over the last few decades, in this region, many iron ore mining towns have emerged, e.g. Goa, Chiria, Megataburu and Kiriburu, shown in the location map of the study area (figure-1).

Methodology

The three sets of remote sensing data used for this study include: Landsat TM (1992, 2005) and LISS-III (2014) and other materials used are topographic maps (2005). The details of the data used are given in table-1.

Table-1
Data used in the present study

Different Data Source	Scale/ Resolution (m)	Year
Landsat 5- TM	30.0 m	1992
Landsat- TM	30.0 m	2005
LISS -III	23.5m	2014

Erdas imagine and Arc GIS software is constructive tools for getting out the land use/land cover layers, SOI top sheets and satellite imageries. Study land use /land cover class has include dense forest, open forest, water body, agricultural land, plantation, wasted land and built up (mining) etc. Image

processing techniques wear practical to make the images for visual explanation of land use/land cover. These comprised geometric correction, radiometric correction, resampling image, mosaic king and clipping of the images. This land use/land cover change methodology (figure-2) is carried out based on the status method. The quality classes stood accepted founded on the visual clarification of the images. Ground information was collected between Jan 2012 to Nov 2014 for the using supervised classification and classification accuracy assessment.

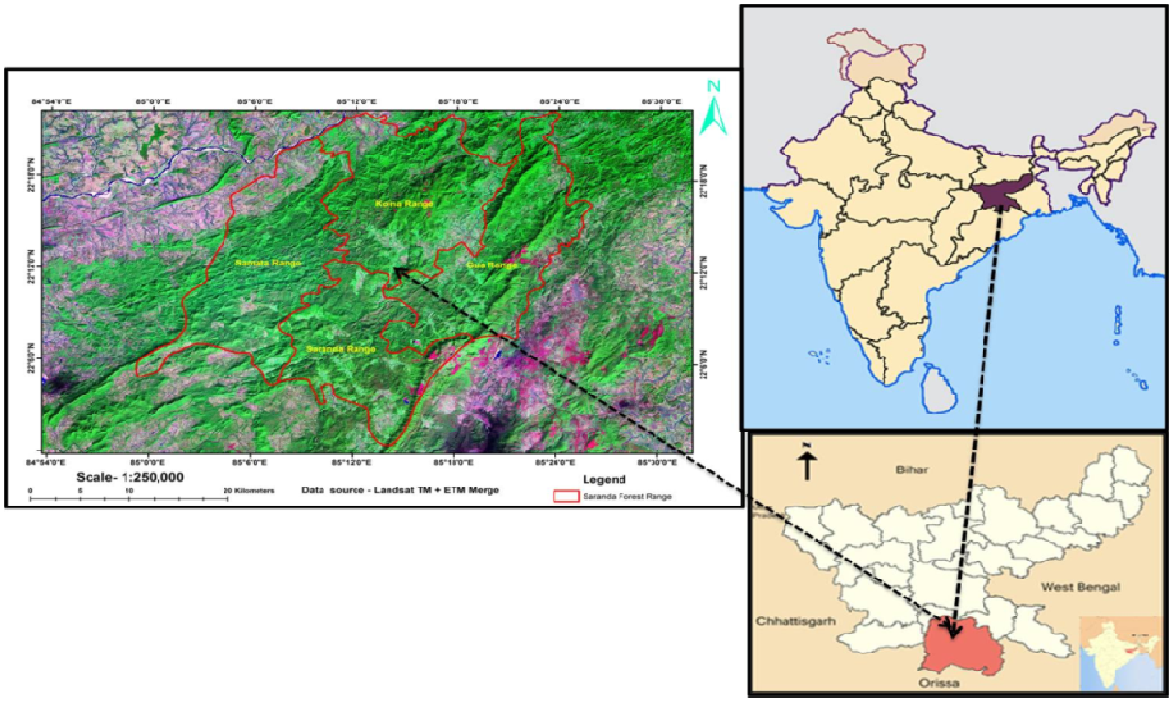


Figure-1
Location map of study area

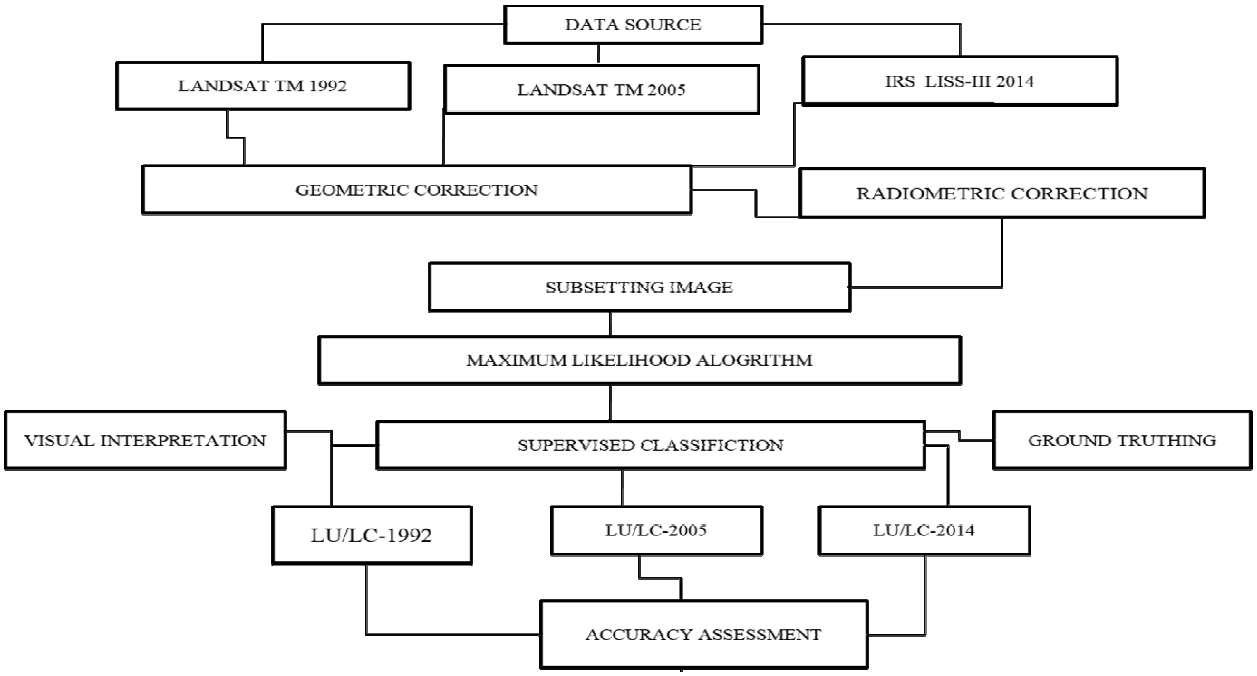


Figure-2
Flowchart of methodologies for LU/LC mapping

Image visual interpretation: The visual interpretation of satellite images is a difficult method. Analysis of remote sensing imagery includes the identification of different marks in image and may be environmental or which involve of point, line or polygon areas. Visual interpretation using elements (tone, shape, size, pattern, texture, shadow, and association) is regularly a slice of our daily lives. Some classes are spectrally disorderly could not be separated classification[5] and visual interpretation compulsory to separate them.

Image classification: Digital image classifications techniques are grouped pixels represent to land cover/land use features. Land use/ land cover classes are classically charted since of digital remote sensing data concluded the process of a supervised image classification[6] and the overall image classification is to automatically classify all pixels in image into land cover/ land use classes[7].

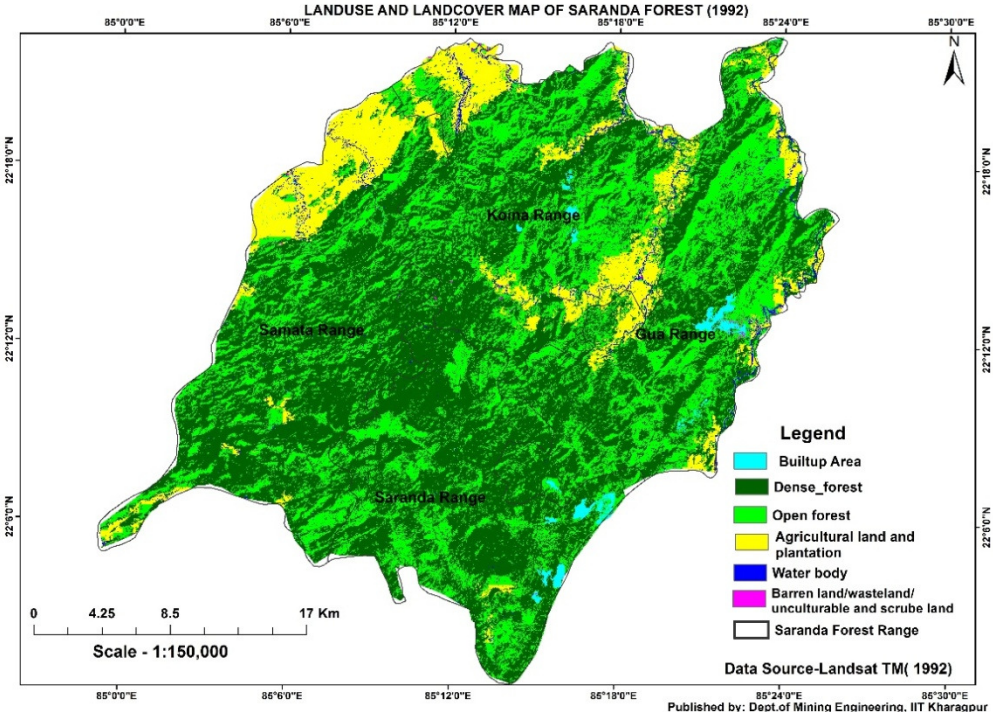
This area was classified into six classes: dense forest, open forest, agricultural land, wasteland /barren land and built-up (mining area). Delineation of land cover/ use classes and the area are shown in table-2.

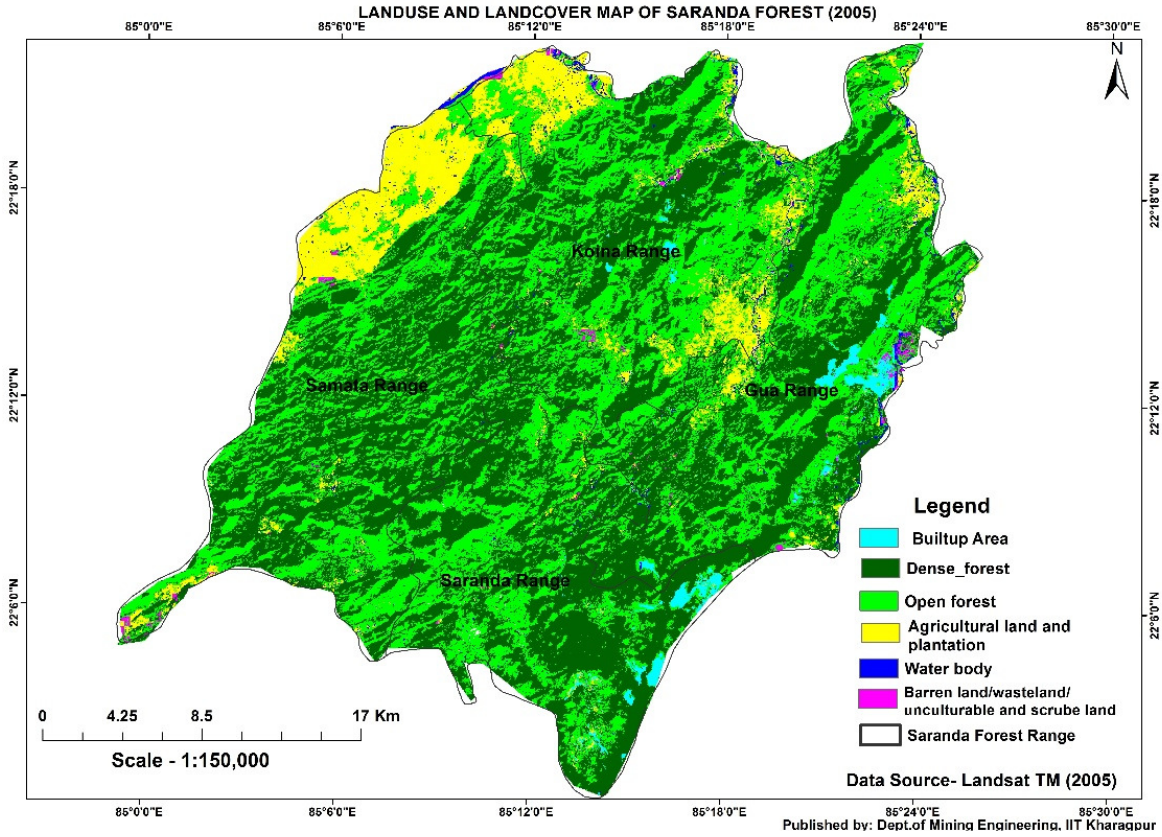
Accuracy assessment: Image analysis and accuracy assessment have corrected contract amongst a standard assumed to be correct and a classified image of unknown class[8]. classification images accuracy assessment was approved using 150 points, 100 points since field survey data and 50 points current topographic maps (2005) and help the ISRO Bhuvan land use/land cover map (2010).The land cover/land use representing of the 3 images, auxiliary data and the result of visual explanation was combined with the classification outcome using GIS in instruction to progress the classification accuracy of the classified images.

Land cover/ land use change detection: The change detection method was applied in dissimilar application areas ranging from monitoring the land cover and land use change using satellite imageries to difference detection on risky locations. A change detection matrix was shaped with the help of erdas imagine software[9].

Results and Discussion

After applying the classification techniques on both satellite imageries important changes in land use/cover are found. The Land use classification map is shown for 1992, 2005 and 2014 respectively (figure-3). Land use/cover class zone was estimated on the basis of the pixel grid cell process by Erdas imagine the software. Land use/ cover class area was assessed on the pixel grid cell method by erdas imaging software. The land use /cover static distribution for each study year as resulting from the area are obtainable (table-3) and area distribution bar graph (Figure-4).The result of the work shows a rapid growth in agricultural land 10.34 to 11.99 percent, open forest 35.2 to 42.30 percent, built-up (mining) 0.78 to 1.07 percent wasteland/barren land 0.28 to 0.50 % and decrease in dense forest area 52.10 to 43.49 percent, water body 1.20 to 0.62 percent. The present revision the overall classification accuracy was started to be 88.54 %in1992, 89.23 % in 2005 and 90.03 % in 2014. Details of classification images accuracy of 1992, 2005 and 2014 can also be found (table-3).





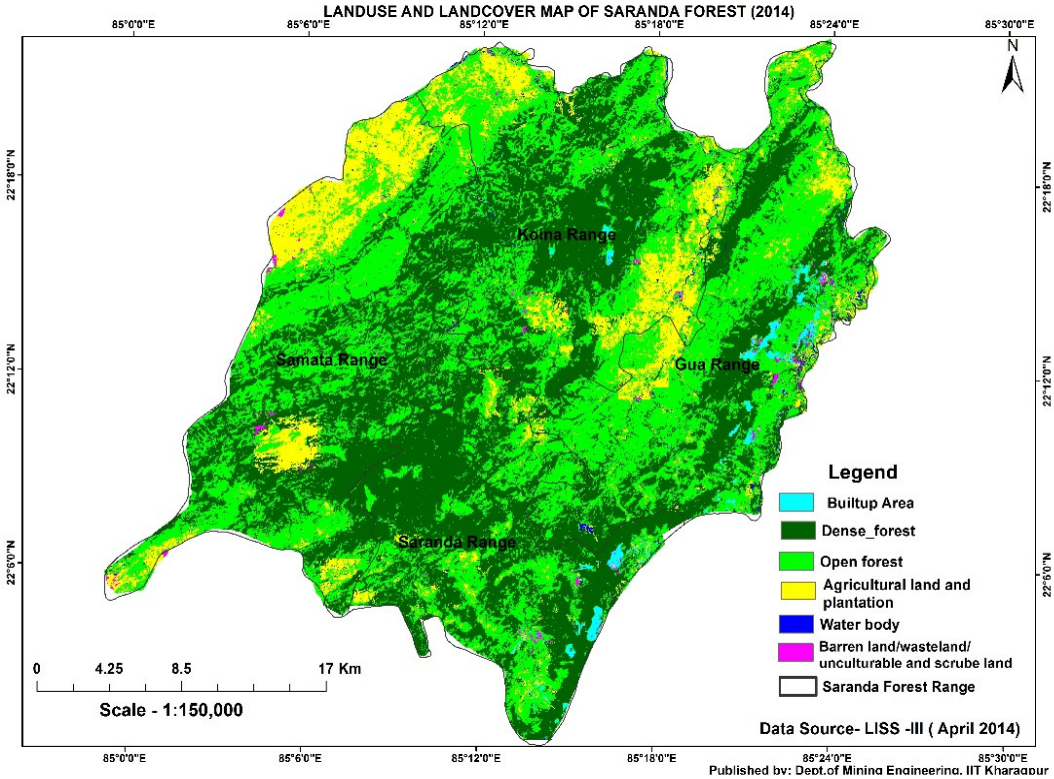


Figure-3
Land use Land cover map in Saranda forest (1992, 2005 and 2014)

Table-2
Area and percentage of changes of different land cover classes of 1992, 2005 and 2014 images.

Land Use and Land cover class name	1992 Area(ha)	1992 Area (%)	2005 Area(ha)	2005 Area (%)	2014 Area (ha)	2014 Area (%)
Dense forest	51096	52.10	46389	47.08	42886	43.49
Open Forest	34591	35.27	39484	40.07	41716	42.30
Water body	1179	1.203	882	0.89	616	0.62
Agricultural land and plantation	10140	10.34	10470	10.62	11828	11.99
Barren land/wasteland	283	0.28	406	0.41	494	0.50
Built-up (mining)	765	0.780	894	0.90	1060	1.075

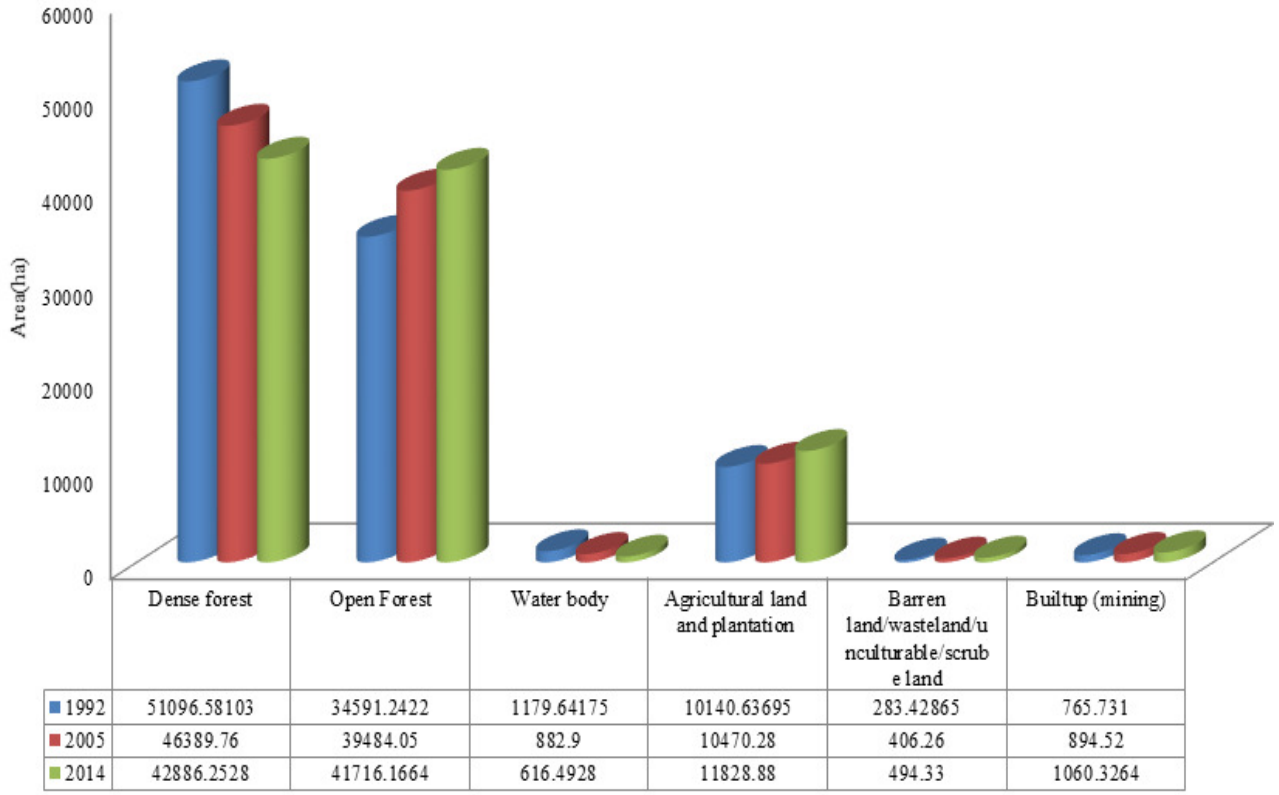


Figure-4
Area distribution bar graph (1992, 2005 and 2014) in Saranda forest

Conclusion

The study obviously recognized the remote sensing devoted through GIS can be an influential tool aimed at mapping and assessment of land use/land cover deviations of fixed area. The major changes in the land use/ land cover through the study retro among the years 1992, 2005 and 2014 recorded about stimulating explanations. The land use/land cover data through the study retro (1992, 2005 and 2014) of the designated convinced denotation deviations which may not expression any important environmental effect. However, these drifts need to be closely observed for the sustainability of environment in the future.

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Table-3
Accurate statistics for the classification result

Class name (1992)	**Producer's accuracy (%)**	**User's accuracy (%)**	**Kappa statistic**
Dense forest	92.00	91.43	0.83
Open Forest	88.00	89.00	0.86
Water body	91.00	90.56	0.90
Agricultural land	83.00	83.00	0.74
Barren land	78.00	77.28	0.68
Built-up (mining)	100.0	100.0	1.00
Class name (2005)	**Producer's accuracy (%)**	**User's accuracy (%)**	**Kappa statistic**
Dense forest	93.00	93.00	0.91
Open Forest	90.00	91.37	0.89
Water body	100.0	100.0	1.00
Agricultural land	82.00	79.64	0.76
Barren land	74.00	71.41	0.70
Built-up (mining)	100.0	100.0	1.00
Class name (2014)	**Producer's accuracy (%)**	**User's accuracy (%)**	**Kappa statistic**
Dense forest	89.00	88.53	0.87
Open Forest	94.00	93.11	0.91
Water body	100.0	100.0	1.00
Agricultural land	80.00	80.00	0.80
Barren land	79.00	78.56	0.75
Built-up (mining)	100.0	100.0	1.00

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